Name: Solution

(8 pts) 1. Complete the indicated operation giving the result in both "$a+bi$" and "$\mathrm{Re}^{i\theta}$" forms. Watch your units! And enter answers in the appropriate box.

Operation	"$a+bi$"	"$\mathrm{Re}^{i\theta}$"
(1+i)-(4+4i)	$-3-3i$	$\sqrt{18}\, e^{\frac{5}{4}\pi i}$
(1+2i)+(1-4i)	$2-2i$	$\sqrt{8}\, e^{i(-\frac{\pi}{4})}$
$e^{\pi i}e^{\frac{\pi}{4}i}$	$-0.71-0.71i$	$e^{i\frac{5\pi}{4}}$
$10e^{2\pi i}/e^{(\frac{\pi}{2}i)}$	$0-10i$	$10e^{i\frac{3}{2}\pi}$

$\pi + \frac{\pi}{4}$

(7 pts) 2. Consider the following equation.

$\frac{1}{x}=\frac{1}{a}+\frac{1}{b}$. Find x in terms of a and b, i.e., $x=?$

$$x = \frac{1}{\frac{1}{a}+\frac{1}{b}} = \frac{1}{\left(\frac{a+b}{ab}\right)} \rightarrow \quad x = \frac{ab}{a+b}$$

(7pts) 3. Find the inverse of the matrix below. Show work and enter result in the space provided.

$$\begin{bmatrix} 2 & 4 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix}^{-1} = \boxed{\begin{matrix} 1/2 & 1 & 0 \\ 0 & -1/2 & 0 \\ 0 & 0 & 1/3 \end{matrix}}$$

$$\mathrm{adj}(A) = \begin{bmatrix} -6 & -12 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & -4 \end{bmatrix} \qquad \det(A) = 2(-6) - 4\cdot 0 = -12$$

$$A^{-1} = \frac{1}{\det A}\,\mathrm{adj}\,A = -\frac{1}{12}\begin{bmatrix} -6 & -12 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & -4 \end{bmatrix}$$

$$= \begin{bmatrix} 1/2 & 1 & 0 \\ 0 & -1/2 & 0 \\ 0 & 0 & 1/3 \end{bmatrix}$$

$\mathcal{L}(\dot{y}(t) = 10\sin 2t)$, $x(0) = 1$

$$sX(s) = \frac{10 \cdot 2}{s^2+4} + 1$$

$$X(s) = \frac{1}{s} \cdot \frac{20}{(s^2+4)} + \frac{1(s^2+4)}{s(s^2+4)} \qquad \frac{s^2+24}{s(s^2+4)}$$

$$= \frac{As+B}{(s^2+4)} + \frac{C}{s}$$

$$= \frac{As^2+Bs+Cs^2+4C}{s(s^2+4)}$$

$A + C = 1 \qquad A = -5$

$Bs = 0 \qquad B = 0$

$4C = 24 \rightarrow \quad C = 6$

$$Y(s) = \frac{-5s}{s^2+4} + \frac{6}{s}$$

$$= -5 \cdot \frac{s}{s^2+4} + \frac{6}{s}$$

$$x(t) = -5\cos 2t + 6$$